

# Cell Mitosis

## Teacher Directions

This activity is suitable for use as an independent assignment, Think-Pair-Share, or group task. Student will get practice in analyzing data and presenting this analysis. They will get an opportunity for guided practice in data interpretation, and drawing supported conclusions.

## Student directions

Part I:

Students in a Grade 10 class observed cells from Allium (onion) root tips and whitefish blastulas to determine which cells were undergoing cell division (mitosis) or in interphase (non-dividing). Each student in the class observed one sample on a single slide of, either a root tip or a Whitefish blastula. on each slide 20 cells were randomly selected, identified and tallied. Cells were categorized as dividing (mitosis) or non-dividing (interphase). In the table below raw cell count has been compiled for the class.

Table 1: Counts of cells in Intephase and Mitosis in Allium (Onion) root tips (1A) and Whitefish blastula (1B) from a prepared slide viewed under light microscopy at 400X magnification

1A: Allium root tip cell counts

Student	Interphase	Mitosis
1	10	10
2	17	3
3	18	2
4	15	5
5	15	5
6	11	9
7	14	6
8	15	5
9	7	13
10	7	13
Average		

1B: Whitefish blastula cell counts

Student	Interphase	Mitosis
1	13	7
2	15	5
3	17	3
4	14	6
5	13	7
6	14	6
7	16	4
8	11	9
9	14	6

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10	12	8
Average		

1. **Calculate** the average number of cells in interphase and mitosis for both the Allium and whitefish blastula.
2. **Construct** a pie graph of the average number of cells in interphase and mitosis for both Allium and Whitefish blastulas.
3. **Determine** which cell type is dividing faster.

### Part II:

In a follow-up exercise each student identified 50 dividing cells in a slide of either Allium root tip or a Whitefish blastula. The phase of cell division for each of the dividing cells was identified and the data were tallied in a data table. In the table below raw cell count has been compiled for the class.

Table 2: Counts of cells in the four phases of Mitosis in Allium (Onion) root tips (2A) and Whitefish blastula (2B) from a prepared slide viewed under light microscopy at 400X magnification

#### 2A: Allium root tip counts for dividing cells

Group	Prophase	Metaphase	Anaphase	Telophase
1	23	18	8	1
2	25	3	19	3
3	19	11	11	9
4	19	11	11	19
5	38	1	8	3
6	43	2	4	1
7	20	9	17	4
8	20	2	26	2
9	34	3	9	4
10	17	12	3	18
Average				

#### 2B: Whitefish blastula cell counts for dividing cells

Group	Prophase	Metaphase	Anaphase	Telophase
1	35	8	5	2
2	25	13	7	5
3	15	13	13	9
4	15	13	13	9
5	26	14	7	3
6	31	11	7	1
7	27	12	6	5
8	27	17	3	3
9	27	4	10	9
10	23	7	13	7
Average				

1. **Outline** the phases of mitosis.
2. **Calculate** the average number of cells in each phase of mitosis for both the Allium and Whitefish blastula.
3. **Construct** a graph to compare the average number of cells in each phase of mitosis in Allium

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root tips and whitefish blastulas.

4. **Compare** mitosis in plant cells and animal cells.

## Support material

### Markschemes/marketing notes:

Table 1: Counts of cells in Intephase and Mitosis in Allium (Onion) root tips (1A) and Whitefish blastula (1B) from a prepared slide viewed under light microscopy at 400X magnification

1A: Allium root tip cell counts

Average	<b>12.9=13</b>	<b>7.1=7</b>
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1B: Whitefish blastula cell counts

Average	<b>13.9=14</b>	<b>6.1=6</b>
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1. Calculate the average number of cells in interphase and mitosis for both the Allium and whitefish blastula.

- answer in tables. Answers to 1 decimal place however ideally answers are rounded to nearest whole number to approximate appropriate significant digits.

2. Construct a pie graph of the average number of cells in interphase and mitosis for both Allium and Whitefish blastulas.

- Pie graph should show 234 degrees (65%) interphase and 126 degrees (35%) mitosis for Allium (error carried forward applies if averages were not rounded give full points for values calculated correctly using student answers from #1.
- Pie graph should show 252 degrees (70%) interphase and 108 degrees (30%) mitosis for Whitefish (error carried forward applies if averages were not rounded give fullpoints for values calculated correctly using student answers from #1.
- Pie graphs are drawn to scale
- Pie graphs are given meaningful titles

3. Determine which cell type is dividing faster.

- Allium is dividing faster as a greater proportion of its cells are in mitosis (less times spent in interphase).

Part II:

In a follow-up exercise each student identified 50 dividing cells in a slide of either Allium root tip or a Whitefish blastula. The phase of cell division for each of the dividing cells was identified and the data were tallied in a data table. In the table below raw cell count has been compiled for the class.

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Table 2: Counts of cells in the four phases of Mitosis in Allium (Onion) root tips (2A) and Whitefish blastula (2B) from a prepared slide viewed under light microscopy at 400X magnification

2A: Allium root tip counts for dividing cells

Average	25.8=	7.2=7	11.6=	6.4=6
e	26		12	

2B: Whitefish blastula cell counts for dividing cells

Average	25.1=	11.2=	8.4=8	5.3=5
e	25	11		

1. Outline the phases of mitosis.

- Prophase is the first stage and during this stage the nuclear membrane disappears, the nucleolus disappears, spindle fibres form and the chromatin condenses to form chromosomes
- Metaphase: the chromosomes migrate to the equator of the cell and are fully attached to the spindle fibres
- Anaphase: the sister chromatids of the chromosome separate and move to opposite poles of the cell.
- Telophase: the chromosomes unwind and reform chromatin and the nuclear membrane reforms, the nucleolus reappears and the cytoplasm divides into 2 cells each with identical genetic information as the original cell.

2. Calculate the average number of cells in each phase of mitosis for both the Allium and Whitefish blastula.

- Answer in tables accept rounded or answers to the nearest 1 decimal place.

3. Construct a graph to compare the average number of cells in each phase of mitosis in Allium root tips and whitefish blastulas.

- Students should construct a bar graph using a legend to distinguish between bars for Allium and bars for whitefish phases.
- the y axis should be labeled as average number of cells, the X axis should have each of the 4 phases with a bar for Allium and a bar for Whitefish.
- the scale should be appropriate
- the graph should be at least 1/3 to 1/2 a page in size minimum
- the graph should have a meaningful title that mentions both the independent and dependent variable and gives some of the information about how conditions for collection of the data.

4. **Compare** mitosis in plant cells and animal cells.

Characteristic	Animal Cell Mitosis	Plant Cell Mitosis
Centrioles	Visible	No visible centrioles
Division of cytoplasm/cytokinesis	By cleavage furrow/pinches in	Cell plate forms
Chromosome behaviour	Condenses, moves to middle, chromatids pull apart, nucleus reforms	Condenses, moves to middle, chromatids pull apart, nucleus reforms
Spindle fibres	present	present
Any other reasonable comparison		

To achieve full points students must be making true comparisons between plants and animals and

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must have at least 1 similarity and 1 difference.

## **Rubric:**

### **Student work samples:**

### **Additional resources:**

### **Examiner notes:**

### **Command Terms Guidesheet**

## **Objective 1**

Define - Give the precise meaning of a word, phrase or physical quantity.

Draw - Represent by means of pencil lines.

Label - Add labels to a diagram.

List - Give a sequence of names or other brief answers with no explanation.

Measure - Find a value for a quantity.

State - Give a specific name, value or other brief answer without explanation or calculation.

## **Objective 2**

Annotate - Add brief notes to a diagram or graph.

Apply - Use an idea, equation, principle, theory or law in a new situation.

Calculate - Find a numerical answer showing the relevant stages in the working (unless instructed not to do so).

Describe - Give a detailed account.

Distinguish - Give the differences between two or more different items.

Estimate - Find an approximate value for an unknown quantity.

Identify - Find an answer from a given number of possibilities.

Outline - Give a brief account or summary.

## **Objective 3**

Analyse - Interpret data to reach conclusions.

Comment - Give a judgment based on a given statement or result of a calculation.

Compare - Give an account of similarities and differences between two (or more) items, referring to both (all) of them throughout.

Construct - Represent or develop in graphical form.

Deduce - Reach a conclusion from the information given.

Derive - Manipulate a mathematical relationship(s) to give a new equation or relationship.

Design - Produce a plan, simulation or model.

Determine - Find the only possible answer.

Discuss - Give an account including, where possible, a range of arguments for and against the relative importance of various factors, or comparisons of alternative hypotheses.

Evaluate - Assess the implications and limitations.

Explain - Give a detailed account of causes, reasons or mechanisms.

Predict - Give an expected result.

Show - Give the steps in a calculation or derivation.

Sketch - Represent by means of a graph showing a line and labelled but unscaled axes but with important features (for example, intercept) clearly indicated.

Solve - Obtain an answer using algebraic and/or numerical methods.

Suggest - Propose a hypothesis or other possible answer.

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Subject:

Biology

DP Component & Criteria:

B. Data Collection and processing,  
Extended Response Questions/Paper 2 and 3

Component type:

Internal

MYP Criteria:

Criterion E - Processing data